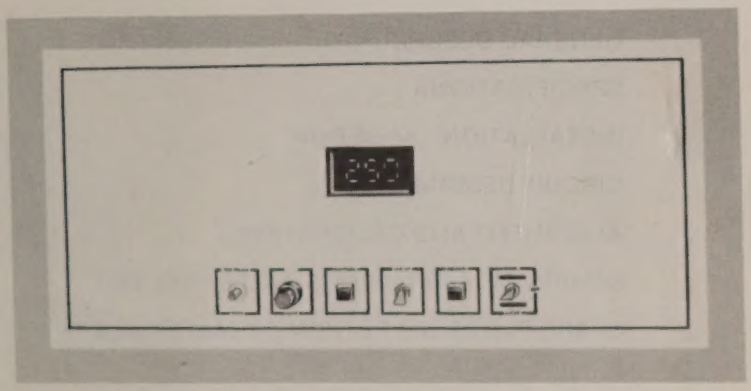

INSTRUCTION MANUAL

Digital Display Temperature Controller Model 628409

THERMOTRON

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I. GENERAL DESCRIPTION

The digital display temperature controller is a two-channel temperature controller with a thermocouple input and a time proportioned output. It provides a three digit display of the actual temperature measured by the thermocouple, or of the set point setting (switch selectable), and it will display in either degrees F or degrees C (factory selectable). The controller features user selectable proportion band, reset time and cycle frame time to obtain the best control for the particular test profile involved. Set point is set via a ten-turn panel pot; or, if desired, a 0 - 5 Vdc programmer can be switched in (to replace the set point panel pot). This enables programmer control of the process variable. The controller is powered by standard 115 VAC 50/60 Hz line power.

II. SPECIFICATIONS:

*INPUT SENSOR: Thermocouple, Type 'T' copper/constantan.
INPUT IMPEDANCE: 10 Megohm.
OPEN SENSOR PROTECTION: Circuit design causes overscale reading and puts controller output to the OFF state if T/C opens.
*CONTROL RANGE: −125°F to +375°F.
−87°C. +191°C.
*SETPOINT INPUT: 0 - 5 VDC
Local - 10-turn locking potentiometer
TIME PROPORTION: Adjustable 0.3 to 20 sec.
+12 VDC ON
−12 VDC OFF
@ ±20 MA max.
PROPORTIONAL BAND: Adjustable 0.2% to 10% of span.
DISPLAY INDICATION: Three 7-segment L.E.D.'s and (−) sign L.E.D.
MEASURING ACCURACY: 0.1% typical; guaranteed ±1% max.
DISPLAY RESOLUTION: ±0.5° for C.
DISPLAY OVER/UNDER SCALE: Underscale - Display holds at bottom scale.
Overscale - Display produces 888
OPERATING TEMPERATURE RANGE: 0°C to 50° C (32°F to 122°F).
POWER REQUIREMENT: 115 Vac, 50/60 Hz ±10%.
10 Volt - amperes maximum.
PROCESS VARIABLE RETRANSMITTED: Analog of process variable retransmitted as 0 - 5 VDC into 300 ohm minimum.
TTL COMPATIBLE OUTPUT: +5 VDC ON
0 VDC OFF.

*Variations available. Special engineering charge may apply.

III. INSTALLATION and SET UP:

INSTALLATION:

This controller is designed to be mounted on a sheet metal panel so that the L.E.D. indicator (back of board) faces the panel. A hole in the panel has a bezel and filter lens to provide the digital display. The other components on the board then face away from the panel to provide easy access to connectors and adjustments. See Fig. 1 (Drawing 470991) for an exploded installation drawing. See Fig. 2 (Drawing 470968) for parts location.

Electrical connections are made as follows:

T11	115 VAC line
T12	115 VAC neutral
T13	Earth ground
T1	T/C (+) Blue Type T
T2	T/C (−) Red
T3	CW of Set Pot - Red
T4	SL of Set Pot - GRN
T5	CCW of Set Pot - BLK
T6	N.C. S.P./Temp SW - Red
T7	N.O. SP/Temp SW - BLK
T10	Com. SP/Temp SW - GRN
T8	Time Prop. + SSR - Red
T9	Time Prop. − SSR - BLK

CHAMBER SET UP PROCEDURE:

When the controller is installed properly, proceed as follows:

1. Place reset jumper on position 9 (TB3).
2. Set the proportional band control R55 full C.W. for widest band.
3. Set cycle time control R50 full C.W. for fastest time.
4. Adjust setpoint pot for a convenient setpoint and let chamber achieve reasonable control (nice, even SSR pulses).
5. Adjust R50, cycle time, until slowest acceptable pulse rate is achieved.
6. Adjust R55, proportional band, C.C.W., a little at a time until SSR pulses just become uneven. Then adjust C.W. until they are again even. Usually, mid-range position works well.
7. Place automatic reset jumper on pin 1 to enable the reset function. Oscillation around setpoint will probably occur. Progressively decrease rate of reset (jumper on higher jumper pin) until oscillations around setpoint disappear.
8. Chamber should control at setpoint without oscillation.

Optimum controller adjustments need not be the most sensitive adjustments, but should be those that produce satisfactory results in a stable system.

JUMPER POSITION	TIME (SECONDS)
1	20
2	32
3	52
4	85
5	141
6	223
7	350
8	480
9	Reset OFF
0	HOLD

IV. CIRCUIT DESCRIPTION

This section briefly describes some of the important functions of the circuit. Refer to the block diagrams and schematic to help in understanding this description.

POWER SUPPLY:

The output of transformer T1 is rectified by diodes CR8-11, filtered, and supplied to fixed three-terminal regulators, U23 and U24. These supply +15 volts and −15 volts, respectively, to power the analog circuitry.

The output of transformer T2 is rectified by diodes CR12 and 13, filtered, and supplied to U29, a +5 volt regulator, which provides power for use by the digital circuitry.

INPUT SIGNAL CONDITIONING:

The thermocouple input on terminals T1 and T2 is applied to the input of U1, a precision instrumentation amplifier. The gain of U1, as determined by R1 and R5, equals 488.

Cold junction compensation is provided by U22, a temperature transducer, which is thermally coupled to the thermocouple input. U22 has an output voltage which is proportional to the temperature but of opposite polarity to the output of U1. U22 is encapsulated to isolate it from sudden ambient changes.

Input zero is provided by R18 and buffered by U2A.

The thermocouple input, ambient compensation signal, and zero offset are summed by R6, R7, and R20 with the proper weighting, and provided to the inverting input of U3A. The span of the signal from U3A is set by R21 and the signal is buffered by U3B.

REFERENCE VOLTAGES:

U22 provides −6.8 volt, which is used to derive all reference voltages. U2C inverts this voltage so that ±6.8 volts may be used by comparators U5A - U5C. U2B and U2D scale down and invert the −6.8 volts to +5 volts reference voltages.

SET POINT SIGNAL:

The +5 volt reference provided by U2B is supplied to T3, one end of a 10-turn panel potentiometer. This potentiometer supplies a 0 to +5 volt set point signal to U3C which acts as a set point buffer. U3D inverts the output of U3C while correcting electrical span errors via the setting of R66.

DEVIATION SIGNAL:

The conditioned process variable (T/C) signal and the set point, along with the zero correction voltage of R26, are summed by U4C to determine the deviation signal, or difference between process variable and set point voltages.

PROPORTIONAL ZONE:

The gain of U4C and, therefore the proportional zone, is determined by the setting of R55, and varies from 10 to 510. The higher the gain, the less deviation from set point necessary to provide full output. Within the proportional zone, the process variable/set point deviation signal no longer provides full output to the heaters. Proportioning action is provided to slow down the heating action to prevent overshoot and

subsequent oscillation above and below set point as is the case with ON-OFF controllers. In fact, with the gain of U4C too high (proportional zone too narrow), controller action approaches ON-OFF control. With the proportional zone set wider, process thermal losses result in a droop, wherein the process temperature levels off at some point that is actually below set point.

AUTOMATIC RESET:

This controller corrects for droop by providing automatic reset. The output of U4C is provided to the input of U25 which acts as an integrating amplifier. Capacitor C3 and jumper selectable combinations of R10 through R17 provide user selectable, automatic reset time. Contacts of relays K1 and K2 determine when the integrator is activated.

The output of U25 is monitored by U5A and U5B, a double-ended window comparator, to determine when the process is within the proportioning zone and the contact of K1 is closed. The (+) terminal of U5A is supplied with a reference of +6.8 volts. The (−) terminal of U5B is supplied with a reference of −6.8 volts.

The (−) terminal of U5A and the (+) terminal of U5B are tied together and monitor the signal output of U25. If that output is greater than 6.8 volts, either positive or negative, the output of either U5A or U5B will be low and Q1 will be turned OFF. When we enter the proportional zone the output of U25 will be less than 6.8 volts and the outputs of both U5A and U5B will be high causing Q1 to conduct, and thereby causing K1 to operate.

The collector of Q1 is monitored by U5C to determine whether K1 is operated. If Q1 is conducting, its collector will be approximately ground potential, the output of U5C is negative, and timing capacitor C8 is discharged. The output of U5D causes Q2 to conduct and relay K2 to operate and remove the shunt from the integrator capacitor C3. The integrator is operating.

The integral time constant is determined by the value of C3, the resistance of R10, and the value of resistance selected by a jumper on TB3.

At the first instant that K1 closes and K2 opens, the voltage across C3 is 0 volts and the entire output signal of U25 is still applied to the (−) input terminal of U25. As C3 charges, the voltage across C3 increases so the feedback voltage on the (−) terminal of U25 is less positive and the gain is effectively increased. This tries to increase the value of U25 output; but, at the same time the heat signal is bringing the process variable closer to set point which reduces the deviation input.

The charge time of C3, as determined by the resistance value selected, determines how fast the gain of U25 is increased by the decrease in negative feedback. As explained, the increasing gain of U25 has the effect of adding the integrated portion of the output of U25 to the input deviation signal.

The amount of reset action that must be used is dependent on two factors: (1) the time required for the process variable to reach set point once it has entered the proportional band and, (2) the amount of additional output signal that must be added by the integrator to overcome thermal losses or droop.

If the jumper is set to add a large amount of resistance in the charge path of C3, the gain of U25 will be increased very slowly but the process variable will eventually reach set point. If the resistance added is smaller, the gain of U25 is increased faster. If the gain is increased at a faster rate than the deviation signal is being reduced, the output of U25 is repeatedly increased to the point where the window comparator will cause K1 to release; and, as soon as the output again falls within the window of the comparator, the integrator will increase the gain again. This may cause the process variable to overshoot the set point and possibly cause oscillation around the set point. (See Section III for control adjustment.)

As previously stated, when Q1 is conducting, Q2 conducts and operates K2 relay. Timing capacitor C8 is discharged. When Q1 extinguishes, timing capacitor C8 begins to charge. If Q1 does not conduct again before C8 charges for about 45 seconds, U5D saturates negative, Q2 extinguishes, and K2 releases, thereby resetting the integrator. The integrator should only function again when the deviation enters the proportional zone after a step change.

TIME PROPORTIONING:

A triangle waveform is generated by U6A and U6B. The triangle wave will be combined with the deviation correction voltage to provide a variable ON/OFF cycle for solid state control relays. If the deviation from set point was at a value calling for 50% output, the ON time and OFF time of the control equipment would be of equal duration per cycle.

U6A is a voltage comparator whose output is saturated at about ±14 volts depending upon its inputs. The square wave output of U6A is integrated by C6 and R49, and in conjunction with U6B it provides a triangle wave of the opposite polarity of the output of U6A. This voltage is developed across divider R47 and R48, and when the voltage on the (+) terminal of U6A switches, compared to the (−) terminal, the output of U6A switches. Thus the output of U6A, a square wave, is integrated to form a triangle wave which in turn triggers the square wave generator.

A capacitor will charge to any potential at a rate determined by the RC time (exponential rate) no matter how great or small the potential. Therefore, if the whole ±14 volt square wave is integrated, C6 will charge to a potential where the magnitude of the triangle wave causes a switch in the output of U6A in a short period of time. If less than the full ±14 volts is integrated, C6, charging at the same rate, takes longer to reach the value to cause the polarity of the output of U6A to switch. Thus, the setting of R50 determines the cycle rate of the triangle wave generator by selecting the voltage to be integrated.

The ±2.5V sawtooth and the effective 2.5 V.D.C. offset voltage are summed by U6C to provide a 0 to +5V sawtooth voltage to the inverting input of U4B. The deviation voltage is applied to the non-invertive input of U4B. The output of U4B is saturated negative for all values of deviation 0 to −5V. For positive deviation values, indicating that heat is required, the output of U4B saturates positive during the interval when the

combined inputs cause the non-inverting input to be more positive than the voltage applied to the inverting input. This varies from 0 - 100% depending on the magnitude of the positive deviation and enables the heaters to be pulsed to provide time-proportional heating. The output of U4B is buffered by U4D and provided to T8 to control the heaters.

DIGITAL DISPLAY CIRCUITRY:

An analog input from T10 is buffered, amplified, and conditioned to provide a rapidly up-dated digital display of either the temperature or the set point.

The 0 - 5 VDC analog is amplified and buffered by U6D. The output of U6D, along with zero and span voltages from R67 and R79, are provided to the inputs of U7, a voltage to frequency converter. The square wave frequency is counted by U9 and one-half of U10.

U17 is a precision clock generator, the output of which is divided by the other one-half of U10 and used by the logic control circuit, U16 and U18, to control the derivation of the digital display. The logic control timing diagram of Fig. 3, and the functional block diagram will aid in understanding the operation.

The outputs of frequency counters U9 and U10 are periodically strobed to the inputs of U11 and U12 where they are latched and fed to the inputs of U13, a memory device used as a look-up table. U13 provides a low byte containing data for the two least significant digits and latches it into U15. U13 then provides a high byte containing the most significant digit data to U14. The high byte also instructs U14 to control the (–) sign via Q3. The outputs of U14 and U15 feed the display drivers U19, U20 and U21. The display drivers control the (3) seven-segment displays through limit resistors U26 to U28. Q3 controls the (–) sign LED directly.

The cycle repeats rapidly, continually up-dating the display with correct data.

V. ALIGNMENT and CALIBRATION:

EQUIPMENT NEEDED:
— Digital Voltmeter .001 Vdc resolution.
— Thermocouple calibrator pot. 1°F resolution.
— One test clip lead.
— Oscilloscope 50 mV/div. AC resolution.*
2 V/div. DC resolution.*
— 115 VAC power cord.

CAUTION

HAZARDOUS POTENTIALS EXIST ON THE CIRCUIT BOARD WHEN POWER IS APPLIED. USE EXTREME CAUTION WHEN CALIBRATING.

*Tests performed with the oscilloscope may be omitted if unit appears to be operating correctly.

Note:

Refer to schematic, layout drawing and Figure 2 for guide to parts locations and their functions.

1. Connect scope gnd. and DVM gnd. leads to TP6.
2. Connect power line to T11, power neutral to T12, and earth ground to T13.
3. Apply 115 VAC line power to unit.
4. Connect DVM (+) lead to TB2, Pin 1 and check for +15 Vdc ±0.6V.
5. Connect scope (+) lead to TB2, Pin 1 and check for less than 30 mV AC noise.
6. Connect DVM (+) lead to TB2, Pin 3 and check for −15 Vdc ±0.6V.
7. Connect scope (+) lead to TB2, Pin 3 and check for less than 30 mV AC noise.
8. Connect DVM (+) lead to Pin 2 of U29 and check for +5 Vdc ±0.2V.
9. Connect scope (+) lead to Pin 2 of U29 and check for less than 30 mV AC noise.
10. Install thermocouple to proper tabs: red wire T2 and blue wire on T1.
11. Put D.V.M. (+) lead on TP2.
12. Adjust R31 for +5.000 VDC reading on D.V.M.
13. Place D.V.M. (+) lead on TP1 and set calibrator pot for −125°F equivalent (zero). −87°C
14. Adjust R18 for 0.000 VDC reading on D.V.M. ±.002V.
15. Set calibrator pot for +375°F equivalent and adjust R21 for +5.000 VDC reading on D.V.M. ±.002V (span). +190°C
16. Repeat steps 13 - 15 until zero and span are properly set.
17. Remove T/C (+) lead from T1 and check that voltage on TP1 greater than +5.2VDC. Reconnect T/C (+) lead to T1.
18. Rotate setpoint panel pot full C.W.
19. Place D.V.M. lead on TP3.
20. Record D.V.M. reading to ±.001 VDC (should be near +5 VDC).
21. Place D.V.M. lead on TP4 and adjust R66 for ±.001 VDC negative of the reading obtained in step 20 (near −5 VDC).
22. Place calibrate jumper on TB1 in the calibrate position. See Fig. 2, (Drawing 470968)

23. Rotate setpoint panel pot full C.C.W.
24. Place reset jumper on position 9 of TB3. See Figure 2, (Drawing 470968)
25. Place D.V.M. (+) lead on TP5.
26. Adjust R26 for 0.00 VDC on D.V.M. ±.005V.
27. Place calibration jumper on TB1 in the operate mode.
28. Place (+) scope lead on pin 14, U6 and check for 0 - 5 VDC triangle wave. Freqency varies from 0.3 sec. to 20 sec./cycle with pot R50 adjustment. (Use D.V.M. to check approximate values if scope is not available.)
29. Turn R55 fully C.W.
30. Set thermocouple pot at a mid-range value.
31. With D.V.M. still on TP5, adjust setpoint knob so D.V.M. reads approximately +2.5 VDC.
32. Place (+) scope lead on T8 and check for ±15 VDC pulses whose rate is dependent on R50 setting. Set for shipping at approximately 1 pulse/second. (Use D.V.M. if scope not available.)
33. With D.V.M. still on TP5, turn setpoint knob and check that K1 turns off (listen for "click" sound) when D.V.M. reads approximately above +6.8 or below −6.8 Vdc.
34. Keep setpoint knob so K1 is in OFF position (above or below ±6.8 Vdc) and make sure that K2 drops out of the circuit after about 45 seconds. (U5, Pin 8, is saturated at −15 Vdc when relay is OFF.)
35. Place setpoint knob so D.V.M. (on T.P. 5) reads +2.5 Vdc. Listen for both K1 and K2 to reactivate.
36. Move reset jumper from position 9 of TB3 and place it on position 3 of TB3.
37. Monitor D.V.M. and check signal going from +2.5 Vdc to +4.0 Vdc in a time span of approximately 52 seconds. (D.V.M. on T.P. 5)
38. Set calibrator pot at +370°F.
39. Adjust R67 for digital display reading of +370°F. 188°C
40. Set calibrator pot at −50°F.
41. Adjust R79 for −50°F reading. -45.6°C
42. Repeat steps 17 - 20 and check display for accuracy, recalibrating if necessary.
43. Spot check a few points in the middle of the range and check for corresponding readings between the calibrator pot and the digital display.
44. Calibration is complete. Remove all test leads and install on chamber.

NOTE:

Due to offsets of the integrator which cannot easily be calibrated out on the bench, the control point may be slightly removed from the setpoint. This can be adjusted by turning pot R66 C.C.W. to raise the chamber temperature, and C.W to lower the chamber temperature. About one-half turn of the pot at a time works well.

To check setpoint/control point compatibility, monitor T10 with a D.V.M. Place panel Setpoint/Temperature switch in the SETPOINT position and record the D.V.M. reading. Return Setpoint/Temperature switch to the TEMP position and adjust R66 until the TEMP voltage reading matches the SETPOINT voltage reading. If a D.V.M. is not available, simply adjust R66 until digital temperature display is the same as the setpoint display.

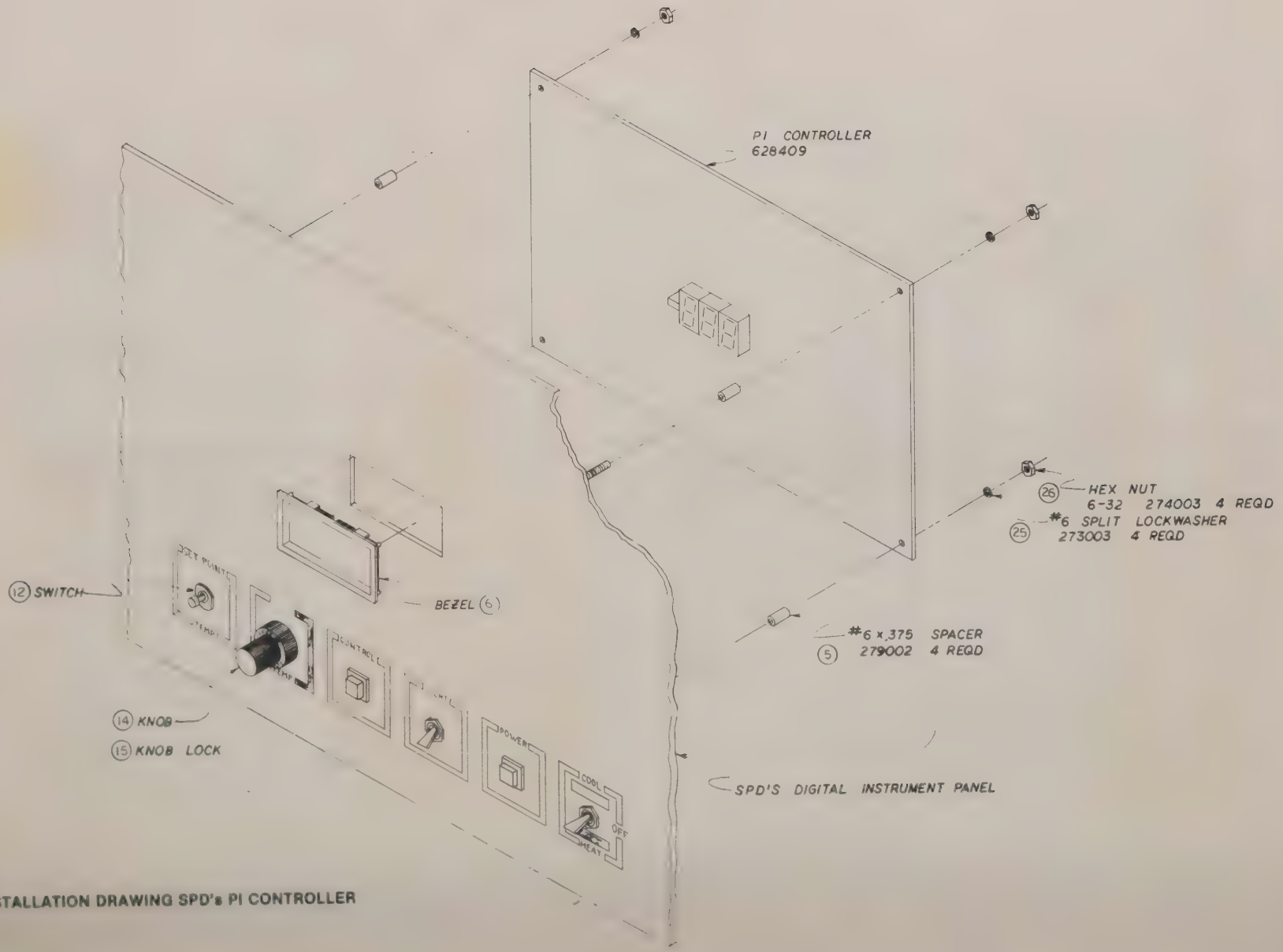


FIGURE 1
470991 INSTALLATION DRAWING SPD's PI CONTROLLER

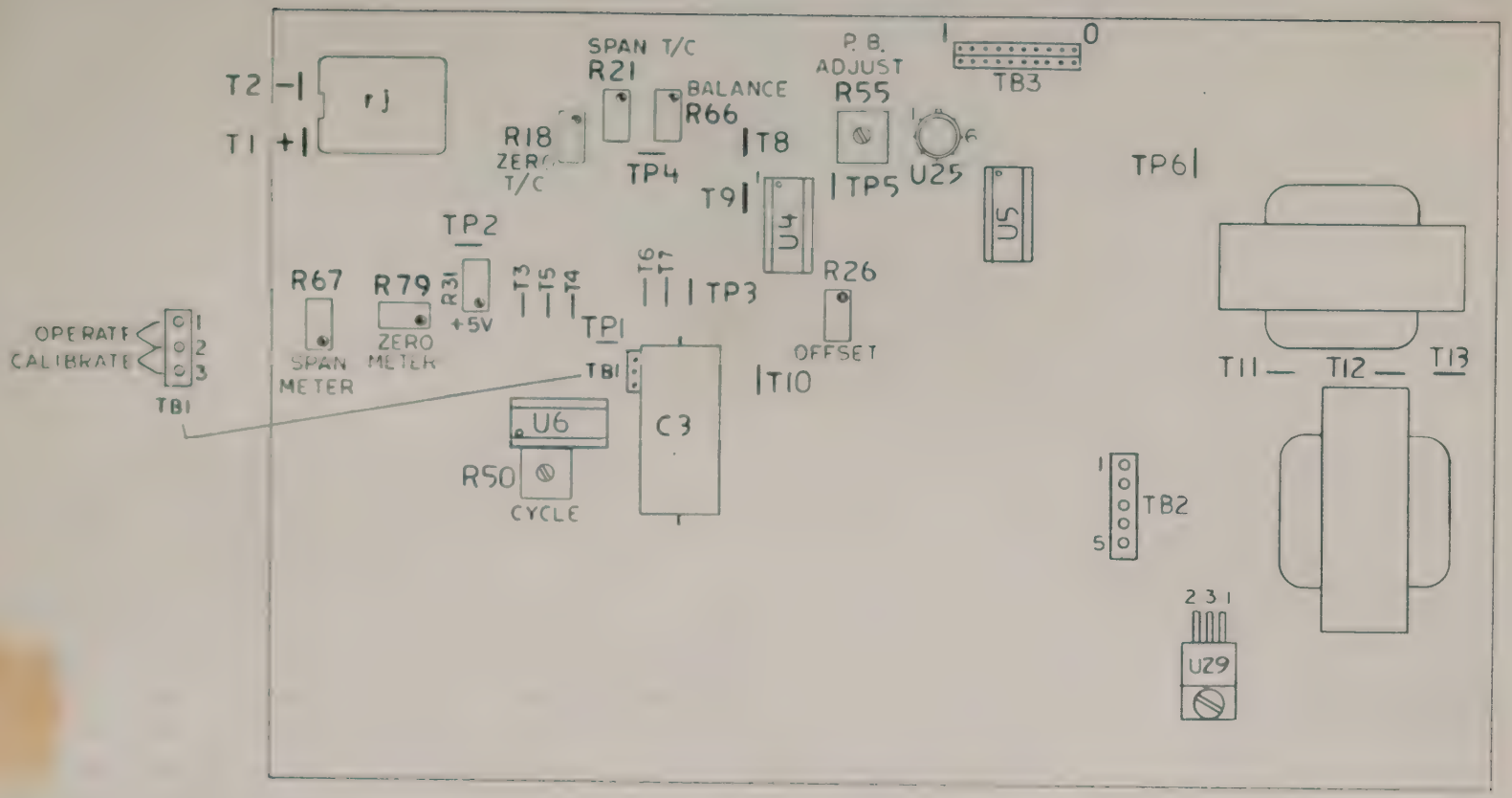
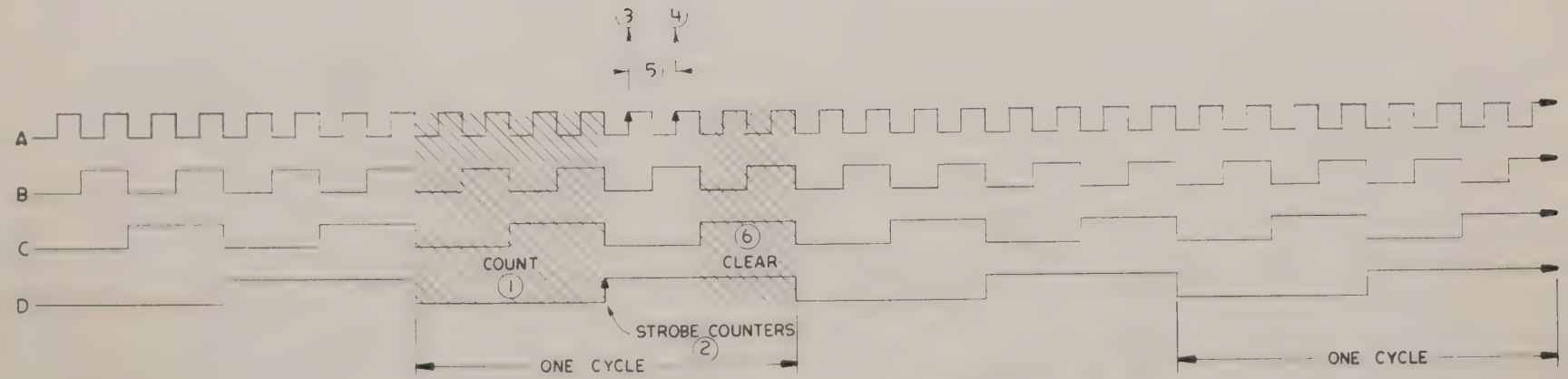


FIGURE 2
470968 PI CONTROLLER POT. LOCATIONS

TIMING DIAGRAM FOR SPD'S PI CONTROLLER

① V-F CONERTER'S INPUT COUNTS UP THE 74LS393'S (U9 & U10)
② STROBE LINES OF 74174'S (U11 & U12) TO INPUT OF 2716 (U13) CONNECTED TO D
③ STROBE LINE OF 74273 (U15) FROM OUTPUT OF 2716 (U13) CONNECTED TO $A \cdot \overline{B} \cdot \overline{C} \cdot D$
④ STROBE LINE OF 74174 (U14) FROM OUTPUT OF 2716 (U13) CONNECTED TO $A \cdot B \cdot \overline{C} \cdot D$
⑤ A10 OF 2716 (U13) (LOWER/UPPER 1K OF MEMORY) CONNECTED TO B
⑥ CLEAR LINES OF 74393'S (U9 & U10) ON COUNTER CONNECTED TO $C \cdot D$

NOTE:
LOGIC GENERATED BY
QUAD INPUT AND GATES



DIVIDED COUNTER PULSES
ORIGINATE FROM LOWER
HALF OF COUNTER U10

A = PIN 3
B = PIN 4
C = PIN 5
D = PIN 6

Figure 3
470989 TIMING DIAGRAM FOR SPD's PI CONTROLLER

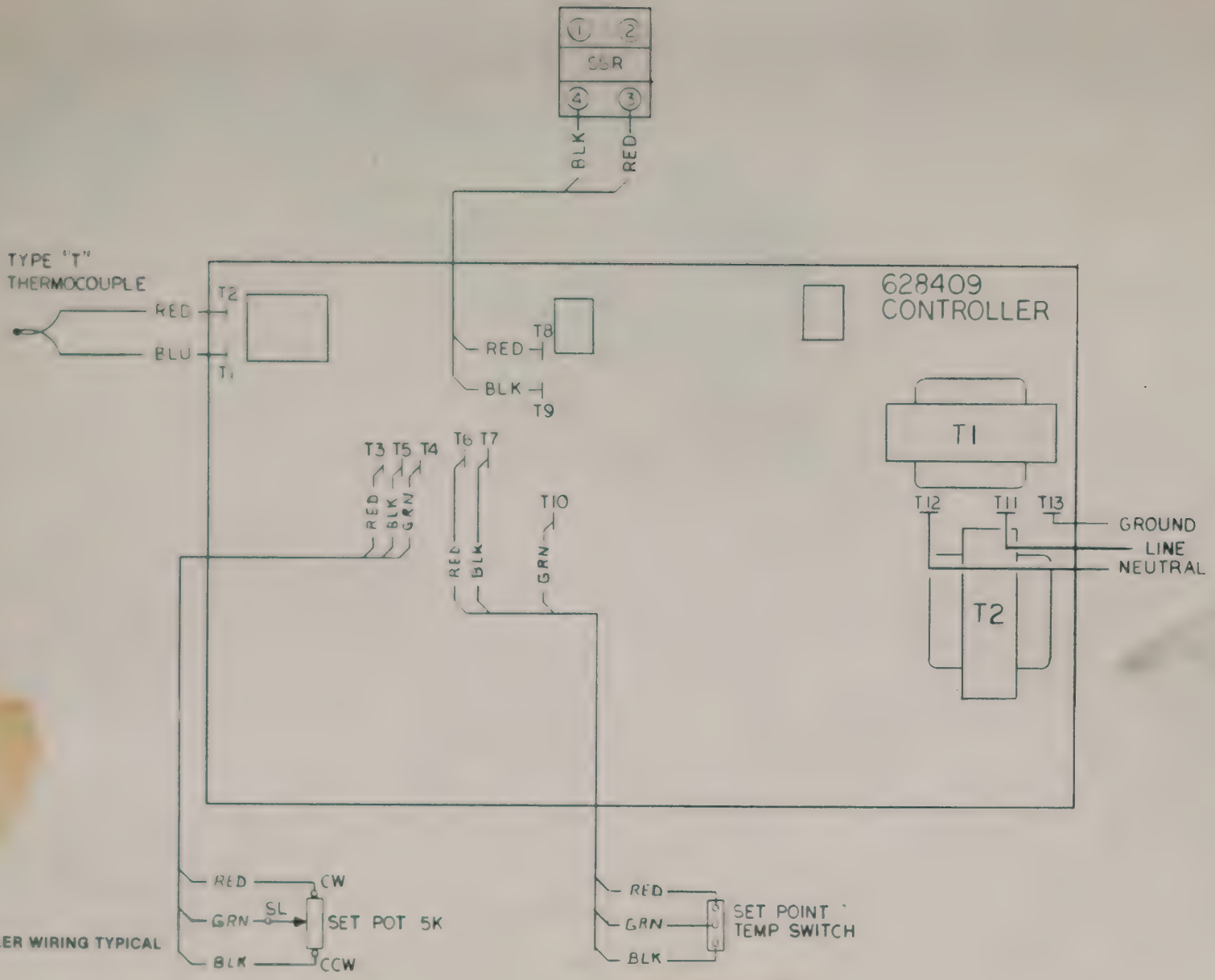


Figure 5A
PI CONTROLLER WIRING TYPICAL

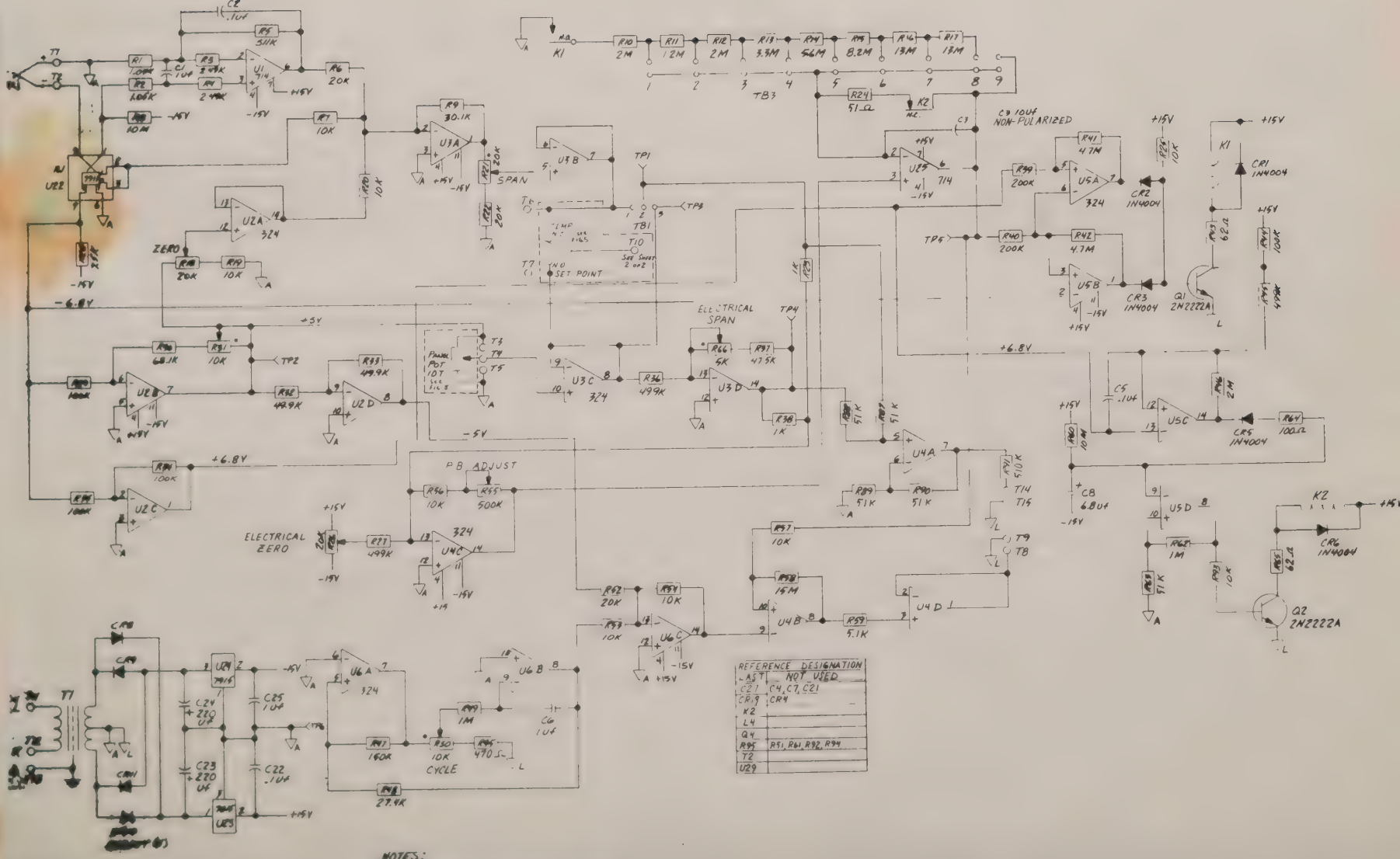
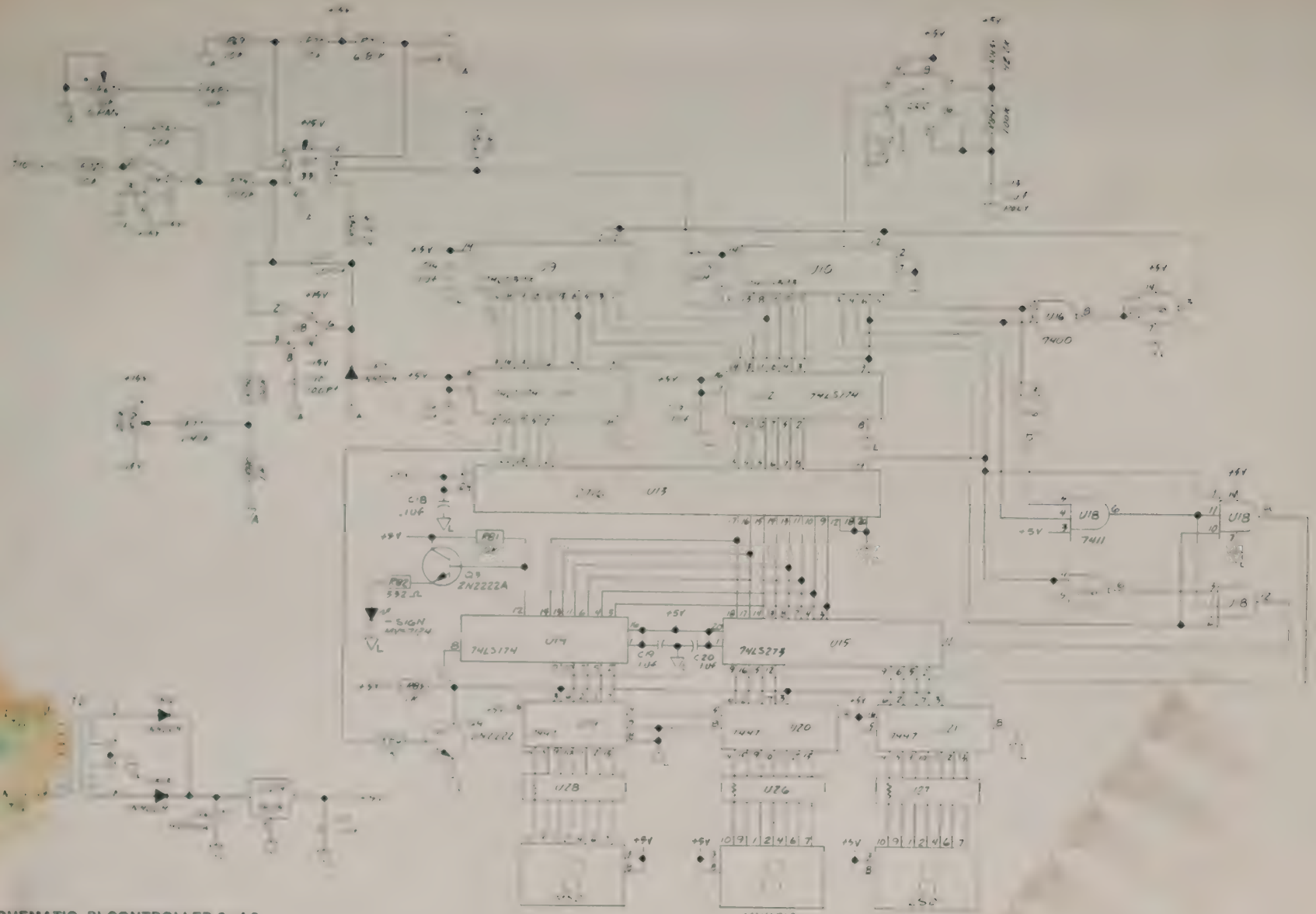
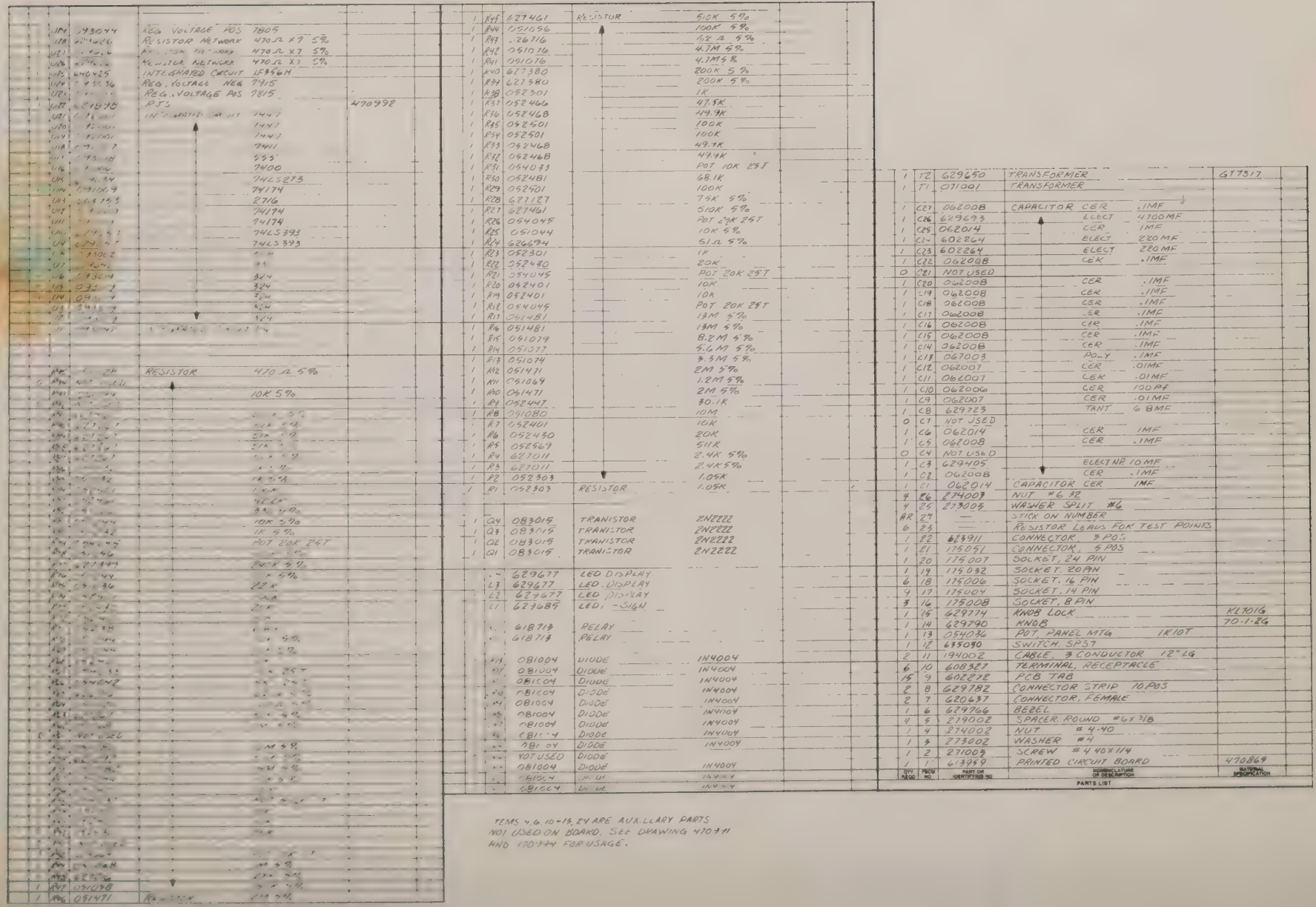


FIGURE 7
470868 SCHEMATIC, PI CONTROLLER 1 of 2

628409 Controller



470868 SCHEMATIC, PI CONTROLLER 2 of 2



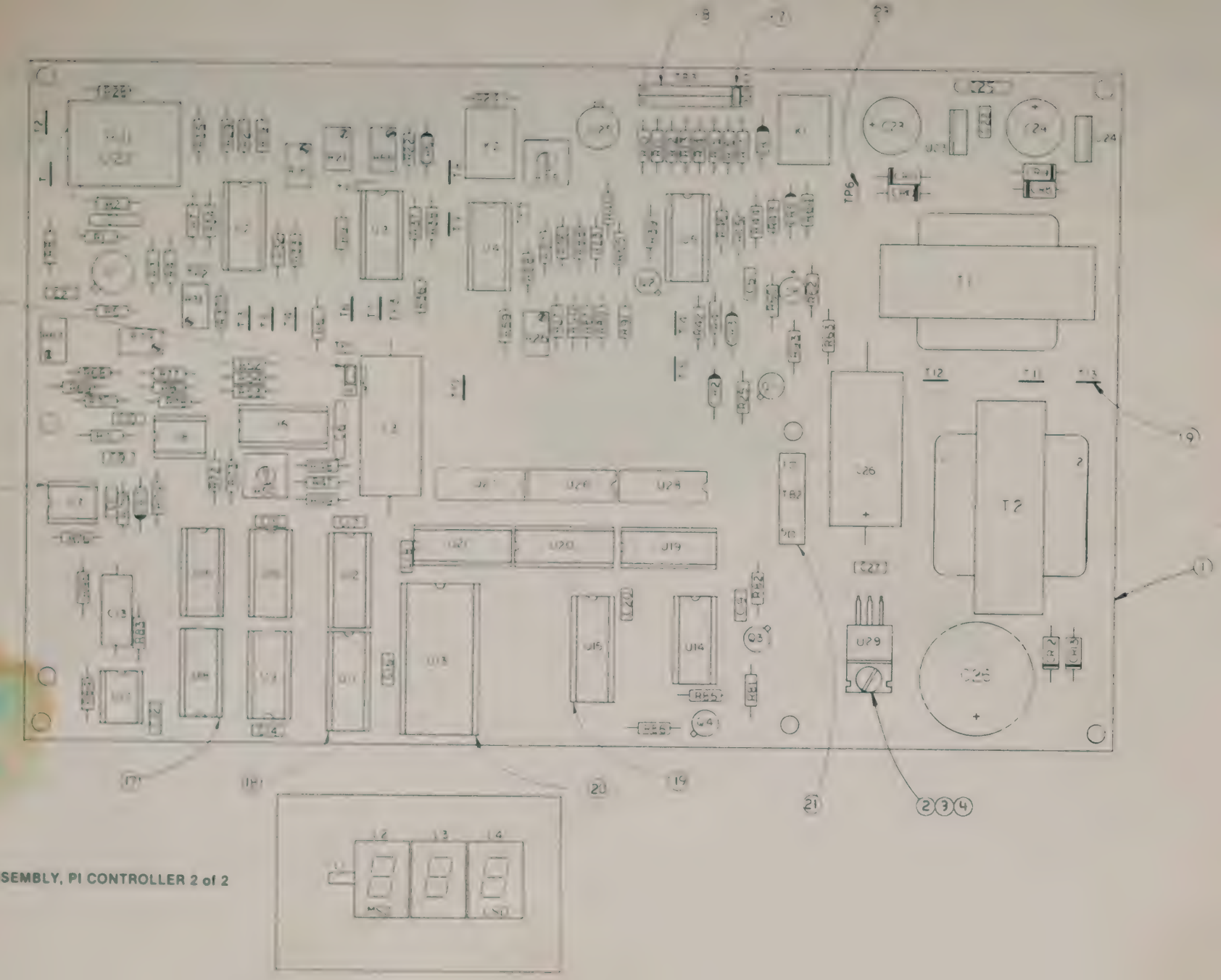
QTY	REQD NO	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION
1	T2	629650	TRANSFORMER	GT7317
1	T1	071001	TRANSFORMER	
1	C27	062008	CAPACITOR CER .1MF	
1	C26	629693	ELECT 4700MF	
1	C25	062014	CER .1MF	
1	C24	602264	ELECT 220MF	
1	C23	602264	ELECT 220MF	
1	C22	062008	CER .1MF	
0	C21	NOT USED		
1	C20	062008	CER .1MF	
1	C19	062008	CER .1MF	
1	C18	062008	CER .1MF	
1	C17	062008	CER .1MF	
1	C16	062008	CER .1MF	
1	C15	062008	CER .1MF	
1	C14	062008	CER .1MF	
1	C13	067003	POLY .1MF	
1	C12	062007	CER .01MF	
1	C11	062007	CER .01MF	
1	C10	062006	CER 100PF	
1	C9	062007	CER .01MF	
1	C8	629723	TANT 6.8MF	
0	C7	NOT USED		
1	C6	062014	CER .1MF	
1	C5	062008	CER .1MF	
0	C4	NOT USED		
1	C3	629405	ELECTNR 10MF	
1	C2	062008	CER .1MF	
1	C1	062014	CAPACITOR CER .1MF	
4	B6	274003	NUT #6-32	
4	S5	273005	WASHER SPLIT #6	
AR	24	—	STICK ON NUMBER	
6	P3	—	RESISTOR LEADS FOR TEST POINTS	
1	J2	629911	CONNECTOR 3 POS	
1	J1	135051	CONNECTOR 5 POS	
1	20	135007	SOCKET, 24 PIN	
1	19	135032	SOCKET, 20 PIN	
6	18	135006	SOCKET, 16 PIN	
4	17	135004	SOCKET, 14 PIN	
3	16	135008	SOCKET, 8 PIN	
1	15	629774	KNOB LOCK	KL701G
1	14	629790	KNOB	70-1-24
1	13	054036	POT, PANEL MTG 1K 10T	
1	12	685090	SWITCH, SPST	
2	11	194002	CABLE, 3 CONDUCTOR 12" LG	
6	10	608327	TERMINAL, RECEPTACLE	
15	9	602272	PCB TAB	
2	8	629782	CONNECTOR STRIP 10 POS	
2	7	620637	CONNECTOR, FEMALE	
1	6	629766	BEZEL	
4	5	279002	SPACER ROUND #6x3/8	
1	4	274002	NUT #4-40	
1	3	273002	WASHER #4	
1	2	271003	SCREW #4-40x1/4	
1	1	613759	PRINTED CIRCUIT BOARD	470869

PARTS LIST

ITEMS 4, 6, 10-13, 24 ARE AUXILLARY PARTS NOT USED ON BOARD. See DRAWING 470971 AND 170774 FOR USAGE.

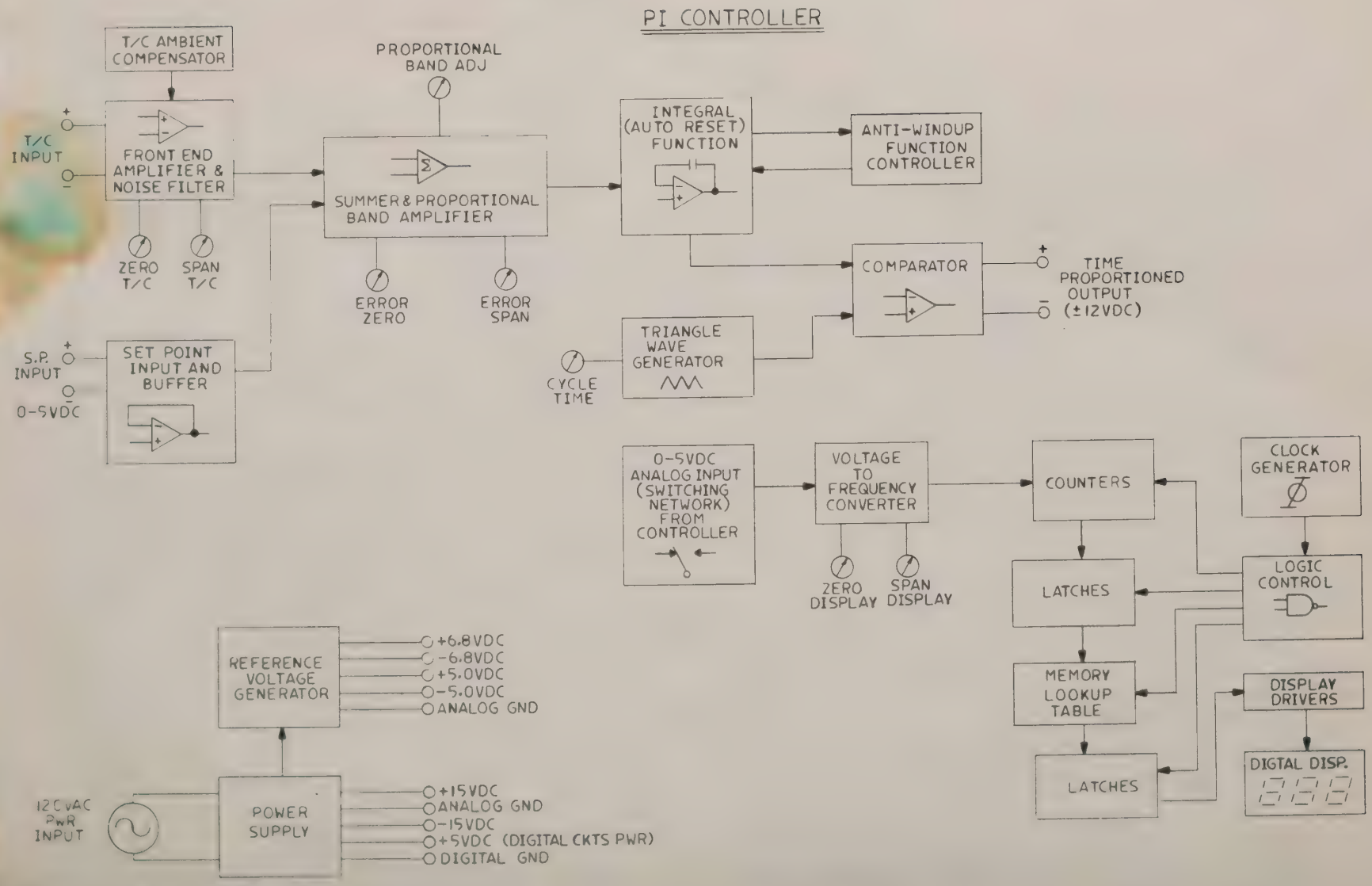
FIGURE 8
470867 ASSEMBLY, PI CONTROLLER 1 of 2

628409 Controller



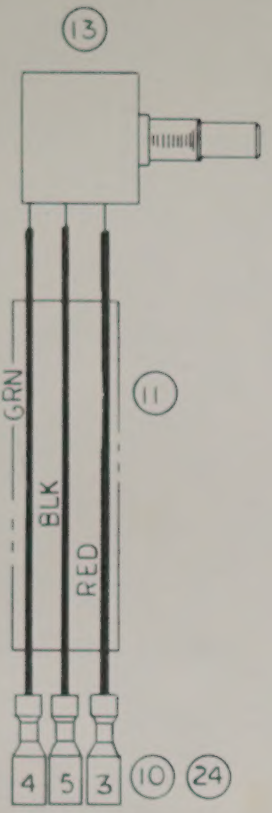
470867 ASSEMBLY, PI CONTROLLER 2 of 2

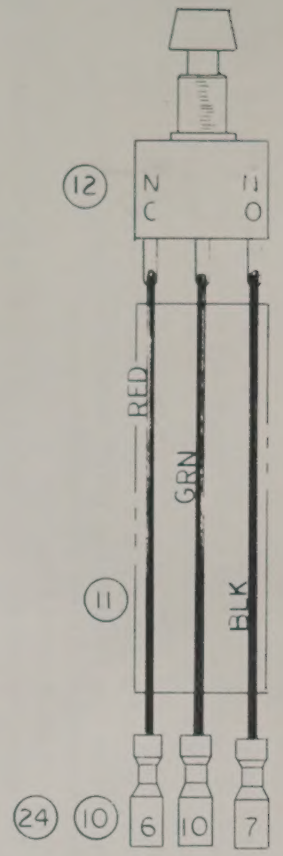
628409 Controller



470984 FUNCTIONAL BLOCK DIAGRAM

628409 Controller





ITEM NOS ON THIS DRAWING APPEAR ON ASSEMBLY 628409 AND DRAWING 470867.

470994 CABLE ASSEMBLY, PI CONTROLLER

SPARE PARTS AND RETURN OF MATERIALS

SPARE PARTS:

Thermotron does not recommend that you keep a supply of parts on hand because the nature of any failure is random. If there were patterns to failures, design changes would have been made. However, a complete listing of parts is shown on Fig. 8 (Assembly Drawing No. 470867).

RETURN OF MATERIALS:

In the event that you have a Thermotron instrument that has failed under warranty, or an instrument which requires repair, call the Controls Department at Thermotron. You will be given an R.M.T. (Return Material Tag) number and authorization for the return of the item. The number should be marked boldly on the outside of your package as well as recorded on your packing slip. When contacting the Controls Department, the following information is required:

1. The complete part number.
2. The model number and serial number, if available, of the Thermotron instrument.
3. The specific complaint regarding failure.
4. A purchase order number is preferred and, in many cases, required.

A telephone number and contact person should be listed on your packing slip so that we know who to contact in case of a question.

For warranty replacement, you will be invoiced upon the date of shipment, and you will be issued credit on that invoice upon our receipt of the defective item.

IT IS IMPORTANT THAT YOU IDENTIFY THE ITEM
WITH THE R.M.T. NUMBER WHICH IS ASSIGNED.

Warranty service is provided without charge; non-warranty service is done on a time-plus-material basis.

Please address the shipment and any related paperwork to:

THERMOTRON INDUSTRIES, INC.
ACS Factory Service
Kollen Park Drive
Holland, MI 49423
Phone: (616) 392-1491

Form No. TI2-066-1-582 Printed in U.S.A.